

view that as long as plants grow so long will cellulose be formed, and with this as a basis nitro-cotton can certainly be prepared. I do not wish to convey the idea that the reason why cotton waste is chosen for making nitro-cotton is its chemical idiosyncrasies, but rather that it is the most abundant and fairly uniform stuff which is available for practical use. Mr. Balls is quite right in thinking that the physical structure of cotton fibre has much to do with the applicability of cotton for making propulsive explosives, but this cuts both ways, because even cotton is troublesome in that those fibres tend to retain acid, which has to be removed by regulated boiling and washing. Hence the suggestion that an artificial "cotton" might be used is well worth considering—dissolved and squirted cellulose being necessarily fairly uniform—and I agree with Mr. Balls that it would not only be possible but also tolerably easy to turn out perfectly uniform gun-cotton made this way.

Nobody has denied from the beginning of the discussion which has taken place in the Press on the subject of cotton for explosives, that nitro-cotton can be prepared from any source of nature which can provide us with cellulose, but the issue is really rather different. It is impracticable for a factory accustomed to using a particular raw material so to alter its operations as to use another raw material without great delay, expense, and in this case much danger. The other difficulty has been mentioned by Mr. Balls, and is that of the artillerist who, given even a better nitro-cotton than that to which he is accustomed, would have to learn his art all over again, and meanwhile it is of more advantage to his country that he should be sighting his gun in the manner to which he is accustomed. To use a homely expression, it is generally a mistake to swap horses in a stream.

THE WRITER OF THE ARTICLE.

The Great Aurora of June 16, 1915.

THERE have been comparatively few auroras here of late years. In that time we have passed through the aurora minimum. Lately, however, there have been distinct indications of an awakened activity in the frequent appearance of auroral glows and arches. But these were generally feeble, and at best showed very little in the way of streamers or other signs of activity.

The night of June 16 was very clear throughout, and gave us one of the finest displays of the aurora that I have seen. Before the moon set there was a very strong, low-lying arch in the north. This was not active, but its intensity seemed to suggest the possibilities of a great display.

At 15h. 30m. G.M.T. the arch was very low and flat, and extended a great distance towards the east and west. There were no streamers.

At 16h. 10m. there were no streamers, but there was considerable action underneath the arch in the way of brightening masses. At 16h. 50m. the arch was double in its eastern part, the upper portion extending to the lower part of Cassiopeia.

By 17h. 10m. the aurora was very brilliant and active, the arch having risen and spread all over the north, nearly as high as the pole. The lower part of the arch was broken with bright moving forms. A few minutes later the arch had risen above the pole, while below it there was very little auroral light except a few streamers. By 17h. 30m. the aurora had quietened down, and the great spasm, seemingly caused by the rising of the arch, had subsided, with the exception of some great bright masses in the north-west, where the remnants of the arch had drifted.

By 18h. 13m. a low, strong arch, slightly active,

had again formed in the north. The new arch soon rose and also became double.

By 19h. 43m. the arch was breaking up, and very long streamers were ascending everywhere. By 19h. 52m. quick waves of light were ascending towards the zenith, succeeding each other with remarkable rapidity. These waves continued without intermission until dawn blotted them out about 21h. 5m.

After about 19h. 40m. the display rapidly increased in magnitude, and attained its maximum splendour at about 20h. 10m. or 15m., when it became too bewildering to describe. The whole heavens seemed alive with flickering and dancing light. The rapid waves of light and the streamers were ascending in all directions, even from the south, to a focus that appeared to be on or near the meridian and about 20° south of the zenith. (Its declination was roughly +23°.) This focal spot was occupied by some of the irregular luminous masses which were momentarily brightly illuminated by these waves. The streamers were no longer slender rays; they were now broad sheets of light along which the ascending waves raced with intense rapidity, giving them the appearance of flames rushing up from the horizon to and beyond the zenith. These quick light waves momentarily and brightly illuminated every object over which they passed. The sky was full of wisps and curved streaks of luminous matter over which the light waves took a sensible moment to pass. This produced a remarkable effect. As the light ran from end to end of them the rapid brightening seemed to give life and action to these streaks and produced in them a writhing and darting motion which they did not possess, for their real motion and change of form was quite sluggish. As late as 21h. 25m., when the sky was bright with dawn, some of the great bright masses were still visible in the north-west.

There was but little colour in the display at any time, though some of the streamers and masses assumed a slight pinkish tinge at about 19 hours. Efforts were made several times to form curtains at the bases of masses of streamers, but no regular curtains were actually formed.

Throughout the night I was photographing with the Bruce telescope. As frequently as possible notes were made of the progress of the aurora. At 20h. 0m. the sky was so brilliantly lighted that I was forced to close the exposure. The resulting negatives were badly fogged with the auroral light, which seemed to be more actinic than moonlight.

The present aurora was much like that of 1903, October 30 (see *Astrophysical Journal*, vol. xxxi., p. 212), in its phenomena and its effects on the telegraph systems, but exceeded it in some respects.

From the newspaper accounts we learn that the aurora was visible over the greater part of the United States and Canada. It was strong even in California.

A despatch to the *Los Angeles Tribune* of June 18, from Spokane (Washington), dated June 17, says:—

"Electrical currents caused by the aurora borealis almost stopped telegraph service in northern Idaho, Montana, and the Dakotas between midnight and 1 o'clock this morning. Up to 9 o'clock this morning the Western Union Telegraph Company reported interrupted service, but not to such a great extent as in the hour following midnight."

In the *Chicago Tribune* of June 18 a despatch from New York, dated June 17, says:—

"Following the spectacular appearance last night of the aurora borealis, which lighted the entire north-west, came reports to-day of crippled telegraph and cable service. The effect of the electricity from the northern lights was felt on wires in a zone stretching across the continent, and as far south as Pittsburgh.

"Across northern Idaho, Montana, and the Dakotas service virtually was suspended. Like unsatisfactory conditions prevailed on all the northern transcontinental lines.

"For several hours during the early morning cable communication *via* the Newfoundland cables of the Western Union was all but paralysed."

During the progress of the aurora, Mr. Frank Sullivan and Mr. E. P. Hubble, of this observatory, tried the wireless receiver here, with which time-signals are received from Arlington, Virginia, Mr. Sullivan at 14h. 45m., when the arch was strong but not active, and Mr. Hubble at 20h. om., when the greatest display occurred. They found in both cases that the static conditions were normal. Mr. Sullivan reports that it was unusually quiet.

E. E. BARNARD.

Yerkes Observatory, Williams Bay,
Wisconsin, June 25.

The Magnetic Storm and Solar Disturbance of June 17, 1915.

A CORRECTION is necessary for the value of r' of arc displacement for the H.F., given in my letter published in NATURE of June 24. It should read, line 18 ($r' = 4.0 \times 10^{-5}$ C.G.S. units). There is also an ambiguity in the preceding line, in the use of the word displacement. The extreme values of the greatest oscillation in the H.F. about 4.15 p.m. amounted to 100', as stated, but the maximum displacement was 76', the value of the base line being 24'.

In his very interesting letter on this subject (NATURE, July 1), Dr. Chree mentions several dates on which sudden movements of the magnets occurred, which are presumably of cosmic origin. It may also be of interest to compare the state of the solar surface on these dates with these sudden movements. The first occurred at 1 p.m. on June 16. On this date the two sympathetic groups of spots, which I have associated with the magnetic storm of June 17, evinced considerable disturbance, the faculæ in the neighbourhood of these two groups, as also bright faculæ conjoined with two other groups nearer the E. limb, showing a decided drift towards the south. On June 18, as already described in my last letter, the whole of the region between these two groups was violently disturbed, and the faculæ, which must have been very bright to be visible in the middle regions of the sun, showed the same southerly drift. As this was visually the most disturbed region of the sun, and, moreover, it was near the heliographic position of the earth, it seemed most likely that this region was the one connected with the magnetic storm, if any such direct connection exists.

On June 14 a bright compact patch of faculæ appeared in the N.E. quadrant on the sun's limb, in which were a few small dots. This new disturbance continued to grow, until on June 21 it had developed into a fine group of large spots near the central meridian. Its mean approximate position was $+17^\circ$ latitude, and 356° longitude. This region was also much disturbed on June 19. Dr. Chree directs attention to the considerable magnetic disturbance which commenced at 3.10 p.m. on June 21 with a sudden movement of the H.F. magnet. Dr. Chree also mentions another sudden commencement on June 7 "of considerable size at a time when Father Cortie tells us the sun was almost free from spots." On that date there was only one group of very small spots at mean latitude $+21^\circ$ and longitude 198° , in a ring of faculæ. But I find on consulting our solar drawings that

M. Henroteau, the observer, has made the following note on the drawing of June 8, with regard to this group of very small spots: "The region of the spots seems very disturbed."

Finally, that quiet magnetic conditions show the twenty-seven day period is not inconsistent with, but would naturally follow from, successive synodic pre-
sessment earthwards of an undisturbed hemisphere of the sun.

A. L. CORTIE.

Stonyhurst College Observatory, July 4.

Use of Tyrosine in Promoting Organic Growth.

I DESIRE to direct the attention of readers of NATURE to the influence of tyrosine in promoting the growth and multiplication of any organisms that may be found in tubes five to ten months after they have been hermetically sealed and sterilised, as described in "The Origin of Life," second edition, 1913, and NATURE of January 22, 1914.

The June number of the Proceedings of the Royal Society of Medicine contains an illustrated communication dealing with the effects of this powerful auxetic when used in the form of a 0.05 per cent. solution. Its influence was tested on a large number of tubes ripe for examination, containing five different kinds of experimental solutions (the constitution of which is given) by adding, with all necessary precautions, about twenty drops of the tyrosine solution to each tube when it was opened. The tubes were then re-closed and replaced in the incubator for three to four weeks. When the contents of these tubes were re-examined after such an interval a very considerable growth and multiplication of unmistakable organisms were found to have taken place, thus tending to disprove the two principal doubts that had been urged against the original experiments by showing (1) that what were found were not mere pseudo-organisms; or (2) organisms which had pre-existed in the solutions, and had been killed by the sterilising process. Photomicrographs of the organisms taken from the tubes before, as well as after, the addition of the tyrosine show its great influence in favouring the multiplication of bacteria, torulæ, and moulds.

I have quite lately heard from the brothers Mary (Institut de Biophysique, Paris) that they have been similarly successful in obtaining from some of their tubes, after the addition of tyrosine, plenty of budding torulæ, as well as delicate spore-bearing moulds, and that they are about to publish an account of their investigation.

The last number of the Proceedings of the Royal Society (B. 609) contains an interesting paper by Prof. Benjamin Moore and W. G. Evans, in which they describe and figure some simple pseudo-organisms, of a kind with which I am quite familiar, obtained from a limited number of tubes containing solutions apparently similar to some of those which I have used. I have prepared and examined more than a thousand of these tubes, and among them have found many barren series. A comparison of their illustrations with mine will show that they have hitherto met with totally different objects. It is true, however, that some of their finds, under the low magnification which they employ, have a superficial resemblance to matted or twisted hyphæ of moulds (see especially Figs. 1, 7, and 11).

The simplest solution from which I have obtained different kinds of moulds, and which I can recommend to others, is one made from 10 per cent. solutions of iron sulphate and potassium ferrocyanide, in which one drop of the former and two of the latter are added to each 30 c.c. of distilled water. The iron stock